INDEX

A

achieved range, 7-2
ADAM, 13-46, 13-61
adjacent charge, 4-2
adjust-fire missions, 9-14, 9-16, 9-17, 9-18
adjusted data, 10-47
aerial observers, H-17
air density, 3-17
ammunition efficiency, 3-1, 4-3, 4-12
ammunition lots, 3-7, 3-8
    interchangeability of, 7-3, 7-4
angle
    of departure, 7-2
    of elevation, 3-13, 3-14, 7-2
    of fall, 3-14
    of impact, 3-14
    of site, 3-13, 8-1, 8-3, 8-11, 8-13
    T, 5-16, 6-26, 13-7
APICM, 13-42
ascending branch, 3-12, 3-15, 3-16
assistant
    fire direction officer, 2-2
    executive officer, 2-2
assurance table, 10-5
azimuth
    index constructing, 6-15

B

baffles, 3-3
ballistics, 3-1
    coefficient, 3-17
ballistic met, 11-5, 11-6, 11-9
base burn DPICM, 13-74
base of trajectory, 3-13
battery operations center, 2-1
beehive, C-21
bore, 3-3
    conditions in, 3-18
    evacuator, 3-3
bourrelet, 3-4
breech recess, 3-2
burst width, 12-5
black magic, 14-2, 14-10, 14-11
    example, 14-14

C

calibrated muzzle velocity, 4-2
calibration, 4-2
    absolute, 4-2
    baseline/M90, 4-4
    comparative, 4-2
    predict technique/validity of, 4-4, 4-12
    subsequent lot/inferred, 4-4, 4-6
call for fire, 2-1
cannon tube, 3-2, 3-4
    gas check seat, 3-2
chamber, 3-2, 3-7
charge, 9-3
charge group, 4-1
charge selection table, 7-7
chart data, 6-1
    announcing, 6-25, 6-26, 6-27
    determining, 6-25, 6-26, 6-27
check firing, 5-21
circular target, 12-30, 12-32
cloud height, 13-7
common deflection, 6-21
complementary
    angle of site, 3-13, 8-1, 8-4
    range, 3-13
    site factor, 8-1, 8-4
computer met, 11-5, 11-10, 11-11
concurrent met
    RATT rule, 11-17
    solution of, 11-17 through 11-39
    technique, 11-15
    vowel rule, 11-16
conditions during flight, 3-19
conditions in the carriage, 3-18
constant error, 3-18
conversion factors, 7-7

coordinated illumination, 9-48, 9-50, 9-51
Copperhead, 13-1
fire order, 13-6
footprint, 13-5
SOP, 13-5
MTO, 13-6
coppering, 3-11
corrections
to air temperature and density, 7-10, 11-24, 11-40
to fuze, 7-22, 11-36, 11-48
to muzzle velocity, 7-16, 11-29, 11-34, 11-46
to range, 11-34, 11-46
counterbore, 3-3

D

deflection, 9-3
correction, 7-16, 9-3
computation of, 10-49
index, 6-18
construction, 6-18, 6-19, 6-20, 6-21, 6-22, 6-23
primary, 6-22
destruction fire, H-8
did hit data (DHD), 10-5, 11-2
dispersion
pattern, 3-18, 3-19
rectangle, 3-18, 3-19
zones, 3-18, 3-19
DPICM, 13-40, 15-17, C-21
drag, 3-16, 3-17
coefficient, 3-17
drift, 7-2, 11-3

E

eight direction met, 11-49
solution of, 11-51 through 11-59
elevation, 8-2, 9-4
elevation gauge line, 7-13, 7-16
emergency firing charts, 14-2
emergency procedures, 14-1
example, 14-13
equivalent full charge, 4-2, 4-12, 4-13, 4-16
erosion, 4-2
table, 7-6
exterior ballistics, 3-12

F

FASCAM, 13-46
aimpoint separation, 13-53, 13-54
battery minefield angle, 13-48
employment procedures, 13-69, 13-72
fire order, 13-48, 13-56, 13-57
minefield density, 13-48, 13-55
minefield employment matrix, 13-49
minefield employment tables, 13-50 through 13-53
planned minefields, 13-48, 13-62
planning modules, 13-48, 13-49, 13-50, 13-53
safety zone tables, 13-67
safety zone templates, 13-69
tactical considerations, 13-48, 13-56, 13-57
technical fire direction procedures, 13-58
unplanned minefields, 13-48, 13-62
fatigue table, 7-6
final protective fire, H-1
fire commands, 1-2, 2-1, 5-1, 5-17, 12-15
elements of, 5-17
examples, 5-23
initial, 5-17
reports, 5-23
sequence, 5-17
special corrections, 5-19
special instructions, 5-18
standards, 5-24
subsequent, 5-17
fire controlman, 2-2, 2-3
fire direction
center, 1-2, 2-1
automated, F-1
evaluation guide, B-1
Standing Operating Procedure (SOP), Appendix A
chief computer, 2-2, 2-3, 2-4, A-2
crew duties, 9-2, 9-32
computer, 2-2, 2-3
definition of, 2-2
equipment, A-10, A-15
objective of, 2-2
officer, 2-2, 2-3, 2-4, A-1
specialist, 2-2, 2-3, A-2

tactical, 1-2, 2-1, 2-3
technical, 1-2, 2-1, 2-3
fire mission processing, 9-1
base burn DPICM, 13-74
Copperhead, 13-6
DPICM, 13-40
emergency mission, 14-3, 14-9
FASCAM, 13-58, 13-69, 13-72
HE adjust MT in effect, 9-16, 9-18, 9-19, 9-20
HE adjust VT in effect, 9-23, 9-24
HE/Q, 9-14, 9-16, 9-17
HE/VT FFE, 9-25, 9-26
HE/ti FFE, 9-19, 9-21, 9-22
high-angle fire, 9-29
high-angle HE adjust, 9-33, 9-34, 9-36
high-angle illumination, 9-53, 9-54
high-angle subsequent adjustment, 9-35, 9-36
illumination, 9-37
coordinated illumination, 9-48, 9-50, 9-51
four gun illumination, 9-48, 9-49
one gun illumination, 9-39, 9-40
two gun illumination, 9-44, 9-45, 9-46, 9-47
immediate smoke, 13-24
laser adjust, 12-36, H-2, H-5
M17 plotting board, 12-34
M825, 13-35
quick smoke, 13-26
radar adjust, H-5
rocket-assisted projectile, 13-8
fire order, 1-2, 5-1, 10-6, 12-15, F-1
special instructions, 5-1
Standing Operating Procedure (SOP)
example, 5-10, 5-13, 9-13
for battalion, 5-9
firing chart, 6-1
construction, 6-1
lower left-hand corner, 6-7
observed, 6-1, 6-28
preparation, 6-8
primary, 6-1
surveyed, 6-1, 6-7
tolerances, 6-28
firing data, 2-1, 9-3
firing tables, 7-1
five requirements for accurate predicted fire, 1-3
five steps to improve firing data, 11-2
forcing cone, 3-3
fork, 7-16, 15-27
four step plotting method, 6-9, 6-10, 6-11
fuze K, F-4
fuze setting, 7-28, 9-3

G

graphical firing table (GFT), 6-27, 7-1, 7-25
100/R, 6-27
determining data with, G-1
drift scale, 6-27
elevation, 6-27
fuze K, 6-29
ICM scales, 6-29
M564 fuze, 6-28
M582 fuze, 6-28
PE_{HB} gauge point, 6-28
PE_{R} gauge point, 6-28
range, 6-27
range K, 6-29
setting, 10-50, 13-19
construction of, 10-52
multiplot, 10-53
two-plot, 10-53
determining data with, G-1
high angle, 10-56
transfer of, 10-57 through 10-59
time of flight, 6-28
VT, 6-28
graphical munitions effects table (GMET), 5-2, C-9, C-10, C-12
graphical site table (GST), 7-1, 8-3, 8-6
C scale, 8-7
D scale, 8-7
grid sheet, 6-1
gun, 3-7
gun target line, 9-38
gunnery, 3-1

H

hasty special corrections table, 12-23 through 12-29
hasty terrain gun position corrections, 12-19

hasty traverse, 12-3
height of burst, 10-18
high-angle GFT, 6-29, 9-30, 9-31
    10 mil sight factor, 6-30, 8-15
high burst registration, 10-16
horizontal control operator, 2-2, 2-5, 6-1
howitzer, 3-7
human error, 3-18

I

illum GFT, 6-30, 9-38, 9-39
    ETI, 6-30
    HOB, 6-30
illum tabular firing table, 7-22
    range to fuze function, 7-25
    RTI, 7-25
    Table A, 7-24
    Table B, 7-25
illumination fire missions, 9-37, 9-41, 9-42, 9-43
immediate smoke, 13-24
inferred calibration, 4-6
inherent error, 3-18
initial elements, 3-13
interior ballistics, 3-1
intervening crest, 15-32

J

Joint Munitions Effectiveness Manual, C-9

K

known point, 6-14

L

labeling, 6-13
lands and grooves, 3-13
level point, 3-12
line of departure, 3-13, 3-14
line of elevation, 3-13, 3-14
line of fall, 3-14, 3-16
line of impact, 3-14

M

M90 velocimeter work sheet, 4-4
magic T, 8-10
manual to computer checks, F-2
massing fires, 5-11
    control of, 5-11
    requirements, 5-11
maximum ordinate, 3-12
mean burst location, 10-21
mean deflection line, 3-19
mean gauge point, 8-7
mean point of impact (MPI), 3-19, 3-20
mean point of impact registration, 10-16
mean range line, 3-19, 3-20
mean weights, 7-5
message to observer, 2-3, 5-1, 5-15, 10-7
    angle T, 5-16
    Copperhead, 13-6
    elements of, 5-15
    PRF, 5-16, 13-6
    splash, 5-16
met
    concurrent, 11-3, 11-10, 11-11
        RATT rule, 11-17
        solution of, 11-17 through 11-39
        technique, 11-15
        vowel rule, 11-16
    corrections, 11-2
    message, 11-5
        ballistic, 11-5, 11-6, 11-19
        computer, 11-5, 11-10, 11-11
        fallout, 11-5
        target acquisition, 11-5
        validity, 11-12, 11-13, 11-14
    subsequent, 11-4, 11-39
    to target, 11-60, 13-75, 13-7, 13-18
        solution, 11-60 through 11-68
met + VE, 11-70, 13-7, 13-13, 13-15, 13-19
met to met check gauge point, 11-70
method of fire, 5-4
mil relation formula, 8-3
muzzle break, 3-3
muzzle velocity, 3-1, 3-4, 3-7, 3-10, 3-12, 3-18, 7-2
    achieved, 4-1
    calibrated, 4-2
    equation, 3-1, 4-12

historical, 4-2
inferred, 4-2
management, 4-1
record, 4-6
standard, 4-1
variations, 3-1, 4-1, 4-6, 11-3

N

nonrigidity of trajectory, 8-1
nonstandard conditions, 1-4, 11-1
nonuniform ramming, 3-9

O

observation post, 6-14
observed firing chart (bn), 6-43
observer
aerial, 1-2
air and naval gunfire liaison company, 1-2
combat observation/lasing team, 1-2
fire support teams, 1-2
firepower control teams, 1-2
forward, 1-2
observer target line, 9-38
obturator band, 3-4
obturator, forward, 3-4, 3-9
obturator spindle assembly, 3-2, 3-10
offset registration, 10-4
operations
assistant, 2-2, 2-3
autonomous, 2-3
battalion directed, 2-3
chief, 2-2, 2-3
origin, 3-12

P

Pasquill weather categories, 13-32
peak pressure, 3-4
percussion plot, 6-30
VI known, 6-30, 6-34, 6-40
VI unknown, 6-30, 6-34, 6-40
piece displacement, 12-2, 12-9
pieces to fire, 5-17, 5-18
pieces to follow, 5-17, 5-18
plotting
equipment, 6-2, A-11
plotting board
M17 or M10, 12-3, 12-4, 12-6, 12-7, 12-34, 12-36, 14-2, 14-9
plotting pencils
6h, 6-2, 6-18
4h, 6-2, 6-12
red, 6-3, 6-12
blue, 6-3
orange, 6-3
green, 6-3
plotting pins, 6-3, 6-16
scale, 6-3
targets, 6-23
point of impact, 3-14
position
constants, 11-2, 11-4
corrections, 12-6
deflection correction, 11-69
fuze correction, 11-69
velocity errors, 11-69
powder model, 4-1
precision registration, 10-6
impact phase, 10-6, 10-7
preferred charge, 4-1, 4-16
pressure travel curves, 3-5, 3-12
probability, 3-18
probable error
definition of, 3-20
deflection, 3-22
height of burst, 3-22
range, 3-20, 3-21
range to burst, 3-22
time to burst, 3-22
projectile, 3-3
APICM, 13-42, C-21
base, 3-2
base burn DPICM, C-22
Beehive, C-21
Copperhead, 13-1, 13-6, C-21
diameter, 3-17
DPICM, 13-40, C-21
efficiency, 4-3, 4-12

family, 4-1, 7-2
HC smoke, 13-23, C-21
high explosive, 9-11, 9-29, C-20
illumination, 9-37, C-20
M825 smoke, 13-23, 13-35
ogive, 3-3
planning ranges, D-1
rocket assisted, 13-18, C-21
weight, 3-11, 4-4
white phosphorous, 13-23
projectile/fuze combinations, 7-5
propellant, 3-2
definition of, 3-2
efficiency, 4-3, 4-12
lot, 4-2
moisture, 3-10
planning ranges, D-1
temperature, 3-10, 4-4, 11-3
type, 4-1
pulse repetition frequency code, 13-6

Q

quadrant elevation, 3-13, 8-2, 9-4
quick smoke, 13-23, 13-24

R

RAAMS, 13-46, 13-61
range
changeover point, 8-8
chart, 3-16
achieved, 3-16
corrected, 3-16
deflection protractor, 6-5
K, 6-29, F-4
probable error, 6-28, 7-17
ranging rounds, H-18
readout average, 4-2
Record of Fire (DA Form 4504), 9-1, 9-5
call for fire block, 9-4, 9-6
computational space and related data blocks, 9-6, 9-7
computing space and administrative blocks, 9-11
fire order and initial fire commands block, 9-8
fire planning/observer subsequent correction block, 9-9
message to observer block, 9-8
policing, 9-15
subsequent fire commands block, 9-10
rectangle, 100%; 3-19, 3-20
registration, 10-1
abbreviated G/VLLD, 10-4
abbreviated HB/MPI, 10-4, 10-16 through 10-33
abbreviated precision, 10-4, 10-14
adjust-fire mission, 10-4
corrections and GFT settings, 10-5
decision diagram, 10-3
determination and application of corrections, 10-47,10-49
DPICM, 10-45
fire order, 10-6
HB or MPI, 10-3
high angle, 10-42
offset, 10-4, 10-45
precision, 10-3, 10-6
example, 10-10 through 10-13
radar, 10-4, 10-34 through 10-41
second lot, 10-9
time phase, 10-8
to the rear, 10-4, 10-46
transfer limits, 10-54, 10-55
types of, 10-3, 10-4
when to conduct, 10-2, 10-3
replot, E-1
resistance
air, 3-16
bore, 3-4, 3-5
initial, 3-2, 3-7, 3-9
restricted charges, 4-2, 4-16
rotating band, 3-2, 3-9, 3-11
rotation corrections, 7-19, 11-3

S

safety, 15-1
aids, 15-4
armed VT, 15-30
computations matrixes, 15-25
intervening crest, 15-32
sheaf
converged, 12-4
open, 12-4
parallel, 12-3, 12-4

special, 12-6
shell casing, 3-2
shift from a known point, 6-24
shooting strength, 4-2, 4-12
shot-start pressure, 3-4
should hit data (SHD), 10-5, 11-2
site, 3-13, 8-1, 8-2, 8-4, 8-11, 8-14, 9-4
average, 8-9
GST determination of, 8-10, 8-14
high angle, 8-2, 8-14
manual determination of, 8-3, 8-12
site-range scales, 8-7
slope, centering, 3-3
smoke projectile (M825 and HC), 13-23
smoke tables, 13-31, Appendix I
special corrections, 12-1, 12-6, 12-30
examples of, 12-39
special situations, H-1
split rings, 3-2
standard conditions, 3-17, 7-1, 11-1
deflection effects, 3-18
deviation from, 3-17
range effects, 3-17
standard muzzle velocity, 4-1
subsequent met
solution of, 11-39 through 11-49
technique applications, 11-49
summit, 3-12, 3-16
surveyed firing charts, 6-1
sweep and zone fire, H-9
switch setting, 13-9

T

table appendixes, 7-25
tabular firing tables, 7-1
Table A, 7-7
Table B, 7-8
comp range, 7-8
Table C, 7-8
cht dir wnd, 7-8
crosswind, 7-9
rg wind, 7-9
Table D, 7-10
Table E, 7-12
Table F, 7-12
air density corr, 7-16
air temp corr, 7-16
change in FS/10 meter dec in HOB, 7-13, 7-17
drift, 7-16, 7-17
elevation, 7-13, 7-16
extracting data, 7-16
fork, 7-16
MV corr, 7-16
range wind corr, 7-16
TOF, 7-16, 7-17
VT setting, 7-16
weight corr, 7-16
Table G, 7-17
angle of fall, 7-19
cotangent of AOF, 7-19
CSF, 7-19
MO, 7-19
PE(change in F), 7-17
PE_R, 7-17
PE_{RB}, 7-19
PE_{TB}, 7-17
terminal velocity, 7-19
Table H, 7-19
rotation corr, 7-19
Table I, 7-19
deflection corr for rotation, 7-19
Table J, 7-22
Table K, 7-22
tactical fire direction, 5-1
target acquisition, 1-2
target analysis, C-1
target attack considerations, 5-1, C-1, C-8
target grid, 6-6, 6-14
targets, 6-14
plotting, 6-23
grid coordinate, 6-24
polar plot, 6-24
shift from known point, 6-24
10 mil site factor, 8-15
terrain gun position corrections (TGPCs), 12-1, 12-2, 12-4, 12-6, 12-14
examples of, 12-3

tick mark, 6-12, 6-23
construction of, 6-12, 6-13
canted, 6-13
3, 5, 7 method, 6-12, 6-13, 6-24
time of flight, 6-28, 7-16, 7-17
time on target, 5-11
time plot, 6-30
VI known, 6-30, 6-36, 6-42
VI unknown, 6-30, 6-36, 6-41
total corrections, 10-47
total deflection correction, 10-49
computation of, 10-49
total fuze correction, 10-48
computation of, 10-48
total range correction, 10-47
computation of, 10-47
trajectory, 3-12
in a vacuum, 3-15
in standard atmosphere, 3-15
initial elements, 3-13
intrinsic elements, 3-12
terminal elements, 3-14
transitional ballistics, 3-5, 3-12
tube conditioning, 3-11
tube memory, 3-11
tube jump, 3-11
tube wear, 3-8

U

untrained observer, H-20
UCARET, 10-50

V

velocity, 3-15, 3-16, 3-17
s V, 11-6, 11-34, 11-36, 11-44, 11-46, 11-48, 11-69
error, 11-69, 11-16, 11-34, 11-46
trends, 3-8
vertical angle, 8-6, 8-11, 8-12, 8-13
vertical control operator, 2-2, 2-5, 6-1
vertical interval, 3-13, 8-1

W

weapon characteristics, 7-5

X

XO's high burst registration, 6-36, 6-42
XO's minimum QE, 15-26

Y

yaw, 3-17

Z

zone-to-zone transformation, H-13